This file contains multiple, linked worksheets to derive and compare planning level cost estimates for the draft Countywide Water Quality Monitoring Plan (CWQMP, Brown and Caldewll, Feb '06, revised May '06) and the Draft NPDES MS4 Stormwater Permit (Ecology, 2/15/06). These estimates are subject to the assumptions and factors listed.

The "Pierce Co" sheet summarizes and compares costs of the two programs.
The "Pierce Co details" sheet contains labor effort estimates for the CWQMP LTT and TD monitoring.
The "MS4 summary" sheet summarizes cost estimates developed in the two other sheets "outfalls" and "BMP Effectiveness" which contain itemized costs for each of these 2 respective MS4 monitoring requirements.

There are two levels of CWQMP cost estimates: one for the 9 LTT stations and another for the 25 LTT station option.
There are two levels of MS4 BMP Effectiveness monitoring: one for the required 35 sample sets, and another for 20 samples, a likely practical limitation given the apparent 2 year sampling period dictated by permit submittal schedule for the QAPP and the final report.

Labor costs can be changed to examine alternative scenarios and the spreadsheets will re-calculate; values of $50/hr are assumed for the CWQMP and $80/hr for the MS4 permit work.
Other variables are also included in the calculations and can be changed, including QC sample rate (assumed 20%), labor hours per sampling event, false start and failure rates, equipment costs, etc.

Developed by Brown and Caldwell, March 2006, revised May 2006 (revisions in green shading) to:
1) increase field labor needs for B-IBI and physical channel monitoring under the LTT program
2) add lab costs for B-IBI sample analysis ($110 per sample, totaling $330 for 3 replicates at each site)
3) increase MS4 permit outfall sampling costs for sediment parameters due to Fact Sheet pg 51 Table.

Annual Costs for Pierce County Monitoring Program Options
non-recurring costs preceded by "NR"
[labor rates can be varied below and for itemized costs on linked *"labor detail"* worksheet]
REVISED 5/18/06

Draft CWQMP (2/14/06)	**Costs per Program Element** LTT (single station)	TD (station pairs)	totals	basis/comment
# stations	9	4		
labor rate	$ 50	$ 50		vary labor rate as needed, $50 assumes County FTE rate
B-IBI	$ 10,000	$ -	$ 10,000	1 visit per year, 2 sites per day+ann data synth
channel	$ 12,600	$ 5,600	$ 18,200	1 visit per year, 1 site per day+ann data synth
in situ bioassays	$ 18,000	$ 11,000	$ 29,000	2 visits per year, 5hrs per site+data synth
continuous mon	$ -	$ 44,000	$ 44,000	15 visits/year, 4 hrs per site +monthly data synth
reporting	$ 10,000	$ 15,000		annual reports
NR cont mon eqpt	$ -	*$ 48,000*	*$ 48,000*	eqpt: $4K puchase, $2K installed per location (doubled for Tier 2 pair)
NR bioassay eqpt	*$ 1,000*	*$ 1,000*	*$ 2,000*	may have to replace eqpt periodically, but is low cost
NR bioassay validatio	*$ 75,000*	$ -	*$ 75,000*	one time effort, consultant supported; $50K validation+ $25K training
first year	$ 126,600	$ 124,600	$ 251,200	
succesive years	$ 50,600	$ 75,600	$ 126,200	
annual hrs per FTE	510	760	1,270	0.64 FTE, for 2 FTEs over 5 years
5 year cost	$ 329,000	$ 427,000	**$ 756,000**	
Grand Total	**$ 756,000**			

These estimates for CWQMP
1) do not include EDMS, travel costs, inflation
2) assumes all field work using teams of 2 personnel

Increase CWQMP	**Costs per Program Element** LTT (single station)	TD (station pairs)	totals	basis/comment
# stations	25	4		alternate to cover 25 stations in Tier 1
labor rate	$ 50	$ 50		vary labor rate as needed, $50 assumes County FTE rate
B-IBI	$ 26,000	$ -	$ 26,000	1 visit per year, 2 sites per day+ann data synth
channel	$ 35,000	$ 5,600	$ 40,600	1 visit per year, 1 site per day+ann data synth
in situ bioassays	$ 50,000	$ 11,000	$ 61,000	2 visits per year, 5hrs per site+data synth
continuous mon	$ -	$ 44,000	$ 44,000	15 visits/year, 4 hrs per site +monthly data synth
reporting	$ 10,000	$ 15,000		annual reports
NR cont mon eqpt	$ -	*$ 48,000*	*$ 48,000*	eqpt: $4K puchase, $2K installed per location (doubled for pair)
NR bioassay eqpt	*$ 3,000*	*$ 1,000*	*$ 4,000*	may have to replace eqpt periodically, but is low cost
NR bioassay validatio	*$ 75,000*	$ -	*$ 75,000*	one time effort, consultant supported; $50K validation+ $25K training
first year	$ 199,000	$ 124,600	$ 323,600	
succesive years	$ 121,000	$ 75,600	$ 196,600	
annual hrs per FTE	1,210	760	1,970	0.99 FTE, for 2 FTEs over 5 years
5 year cost	$ 683,000	$ 427,000	**$ 1,110,000**	
Grand Total	**$ 1,110,000**			

this option same as above except uses 25 Tier 1 stations

Draft MS4 permit, 2/15/06	Outfalls (S8.A)	BMPs (S8.C)	BMPs (S8.C)	Comment/assumption
scenario	minimum rqmt	max practical	minimum rqmt	
min # stations	3	8	8	
min# events	15	20	35	min # events as inferred in permit
QC rate	20%	20%	20%	high QC for organics, clean metals & overall complexity, at least in first year
costs below are	annual costs	total program costs		
analytical	$ 81,000	$ 99,000	$ 174,000	current ARI lab rates, $600/sample assumed for specific pest/herbicides
analytical QC	$ 33,000	$ 40,000	$ 70,000	QC blanks & dupes at same cost per sample
labor	$ 75,000	$ 431,000	$ 755,000	using consultants at $80/hr, with 1 false start and 1 failure per quarter
sediments	$ 24,000	in above	in above	3 sed samples/year, 3 days/sample for 2 consultants at 3 outfalls
acute WET	$ 2,000	na	na	assumes WET labor concurrent with other sampling, but takes planning
flow control BMP	na	$ 67,000	$ 67,000	separate equipment, labor and reporting
reporting	$ 40,000	$ 32,000	$ 32,000	1 annual report per year
NR equipment	*$ 30,000*	*$ 80,000*	*$ 80,000*	$10K per auto sampling station (sampler, flowmeter, housing), installed
NR QAPP	*$ 40,000*	*$ 40,000*	*$ 40,000*	one time cost, approval required, assume one QAPP per program element
first year	$ 325,000	$ 454,500	$ 669,000	
succesive year(s)	$ 255,000	$ 334,500	$ 549,000	
5 year cost	$ 1,345,000	$ 789,000	$ 1,218,000	

Grand Total **$ 2,140,000** max practical (i.e. 20 pairs of BMP effectiveness samples)
$ 2,570,000 implied minimum (i.e. 35 pairs of BMP effectiveness samples)

Other assumptions for MS4 permit estimate:
1. BMP effectiveness: assume 2 year sampling program given permit schedule dictates
2. False starts (insuff rain/duration) and sampling failures (eqpt/human error) assumed to expend 1/2 of the labor needed for a successful event (3 days for team of 2)
3. For simplicity, sampling labor assumes same effort per event for outfall and BMP sampling: 3 days for team of 2, which includes storm tracking, mobilization, demobilization, etc. Assumes 3 outfalls and 4 BMPs (station pairs) to sample per event.
4. Assumes consultants used due to 24-7 availability needed to meet requirements
5. No other costs included for acute WET because permit does not specify acceptance (min survival) criteria, consequences or follow up (TIE) for toxic result, or if tests based on grab or composite (time or flow)
6. For QAPPs, requirement of "one per BMP" as permit states is probably unneccesary and a single QAPP should suffice for each program element (outfalls and BMPs).
7. minimum # sampling events as inferred in permit, but likely max of 20 would be practical limit for BMP effectiveness given apparent 2 year duration.

Cost estimate for typical TMDL study
for fecal coliforms
using the MST approach

Scope assumptions	value	comment
study duration, yrs	1	
number of streams/subbasin	1	
number stations per stream/subbasin	6	
number stormflow sampling events per year	12	
number baseflow sampling events per year	6	
total # samples	108	
labor, man hours per sampling event (team of 2)	16	same for storm and baseflow events, assumes 1 8-hr day for team of 2 to sample 6 sites
labor rate	$50	$90 County labor assumed $50/hr, consultant labor assumed $80/hr
goal for # MST isolates	800	
cost per isolate	$75	isolates (ribotyping) IEH laboratory (Mansour Samadpour)
E. coli test, cost per 3 replicates	$75	need 3 replicates per sample to yield sufficeint # of non-confluent colonies
ancillary parameters, cost per sample	$325	total lab cost of $400/sample including E. coli, and excluding MST isolates
hours for draft report	300	includes data review, validation and synthesis
hours for final report	100	one round of review and edits

Item	Cost using County labor	Cost using consultant labor	comment
QAPP	$ 40,000	$ 40,000	QAPP by consultant
supplies	$ 5,000	$ 5,000	
total sampling labor	$ 14,400	$ 25,920	
total MST	$ 60,000	$ 60,000	
total analytical	$ 43,200	$ 43,200	
draft report	$ 15,000	$ 27,000	
final report	$ 5,000	$ 9,000	
PM	$ 18,260	$ 21,012	10% PM rate
total	***$ 201,000***	***$ 232,000***	rounded up to nearest $1K

scale up options	$ 233,000	$ 263,000	for 10 stations, 1 stream
	$ 249,000	$ 279,000	for 6 stations 2 streams
	$ 312,000	$ 343,000	for 10 stations 2 streams

Labor Cost Summary of Feb 06 Draft CWQMP Long Term Trend (LTT) and Targetd Development (TD) Approaches

[labor rate and other effort factors can be varied and summaries will re-calculate]

Labor costs and hours per station per year using County labor at assumed rate

LTT (single stations)		effort factors					
Item	cost	hrs/yr	hrs/event	events/yr	# FTEs	rate	comment
BIBI sampling	$ 400	8	4.0	1	2	$ 50	doubled labor to 4 hrs/site (2 sites/day vs 4 sites/day)
BIBI data analysis	$ 300	6	6.0	1	1	$ 50	annual data synthesis (not reporting)
BIB sample analysis (3 reps)	$ 330	7	6.6	1	1	$ 50	Aquatic Biology Assoc, $110/sample rep, for 3 reps=$330
phys channel	$ 800	16	8.0	1	2	$ 50	doubled labor to 8 hrs/site (1 site/day vs 2 sites/day)
phys channel data analysis	$ 600	12	12.0	1	1	$ 50	annual data synthesis (not reporting)
in situ bioassay labor	$ 1,000	20	5.0	2	2	$ 50	2 visits per year, 5hrs per site for team of 2 FTEs
in situ bioassay data analysis	$ 1,000	20	10.0	2	1	$ 50	lab dupe, data capture, data synthesis
total per station per year	$ 4,430	89					

note, in this portion:
1) in-situ bioassay method validation/training not included
2) equipment costs not included

TD (station pairs)		effort factors					
Item	cost	hrs/yr	hrs/event	events/yr	# FTEs	rate	
continuous mon labor	$ 6,000	120	4.0	15	2	$ 50	weekly visit first month, then monthly: 4 hrs/station pair for 2 FTEs
continuous mon data analysis	$ 4,800	96	8.0	12	1	$ 50	monthly data synthesis and summary; 1 day effort per station pair
phys channel	$ 800	16	8.0	1	2	$ 50	doubled labor to 8 hrs/site (1 site/day vs 2 sites/day)
phys channel data analysis	$ 600	12	12.0	1	1	$ 50	annual data synthesis (not reporting)
in situ bioassay labor	$ 1,600	32	8.0	2	2	$ 50	2 visits per year, 8hrs per station pair for team of 2 FTEs
in situ bioassay data analysis	$ 1,000	20	10.0	2	1	$ 50	lab dupe, data capture, data synthesis
total per station pair per year	$ 14,800	296					

Cost Estimate Summary for Counties to meet MS4 Stormwater Monitoring Requirements (based on 2/15/06 draft permit)
assumes independent option selected, also, Ports have different scope
revised 5/18/06 to include cost of sediment analysis per Fact Sheet pg 51 Table

Program Element		Cost Element analytical	labor cost	labor hrs	eqpt	sediments	WET	QAPP	Annual Report	total	
S8.A	**Outfall monitoring**	$ 565,000	$ 365,000	4,563	$ 30,000	$ 120,000	$ 8,000	$ 40,000	$ 200,000	$ 1,328,000	
	per year	$ 113,000	$73,000	913		$ 24,000	$ 1,500		$ 40,000	***$ 252,000***	not including eqpt
	program duration, yrs	5									
	per outfall per year	$ 38,000	$ 25,000	304		$ 8,000	$ 500		$ 13,333	***$ 85,000***	not including QAPP

Program Element		Cost Element analytical	labor cost	labor hrs	eqpt	flow control	QAPP	Annual Report	Final Report	total
S8.C	**BMP Effectiveness**	$ 99,000	$ 431,000	5,388	$ 80,000	$ 67,000	$ 40,000	$ 16,000	$ 16,000	$ 749,000
	per event	$ 4,950	$ 21,550	135						
	year 1	***$ 49,500***	***$ 215,500***	***2,694***	***$ 80,000***	***$ 33,500***	***$ 40,000***	***$ 8,000***		***$ 430,000***
	year 2	***$ 49,500***	***$ 215,500***	***2,694***		***$ 33,500***			***$ 16,000***	***$ 320,000***
	# events	20								
	# sites	4								
	program duration, yrs	2								

Program Element		
S8.B	Program Effectiveness	*not included*

Cost Estimate for 2/15/06 Draft MS4 Permit Stormwater Outfall Monitoring Portion (S8.A)
revised 5/18/06 to include cost of sediment analysis per Fact Sheet pg 51 Table

Cost Estimate Factors & Assumptions

# landuses	3	commercial, LDR, HDR for COUNTIES, Cities do Ind instead of LDR
# outfalls per landuse	1	
total # outfalls to sample	3	
# events per year	15	
# false starts per year	4	1 per qtr; no analytical spent, but use 50% of event labor
# failures per year	4	1 per qtr; no analytical spent, but use 50% of event labor
QC rate	20%	
labor rate	$80	
labor hrs per event per outfall	16	3 days for team of 2 (6man days) to service 3 outfalls
sample types:	FW Comp	"full duration" difficult to do without modifying sampler or nursing it to renew bottles
sample types:	Grab	"early...and skimmed" implies manual sampling as only means
acute WET samples per year	1	
years of monitoring in this estimate	5	

Narrative:
- sample 3 outfalls in the entire county, each representing a single lumped landuse
- sample 75% of the storms up to 15 events per year (75% would likely be >15 events, so use 15 min)
- provide flow-weighted composites for list, and *manual* grabs for TPH and bacteria
- do acute WET annually in one summer/fall storm per year (no consequences)
- does not include TIE for WET
- assumes WET sampling labor concurrent with routine event
- sample sediments 3 times per year
- "long term program for trends"
- "calculate annual, seasonal loads for storm and baseflow"

cost/event/outfall			other costs			total annual costs per outfall						reporting	total	
analytical	labor	total	false start, ea	failure, ea	QC analyt	analyt	labor	WET	sediments	total	eqpt	ann report final report	annual	total
$ 1,790	$1,280	$3,070	$1,920	$1,920	$ 32,220	$ 37,590	$24,320	$ 500	$ 7,860	$ 70,270	$ 10,000	see MS4 summary	$ 210,810	$ 1,084,050

Analytical costs

Grab	cost		method
TPH-Dx	$	75	
TPH-Gx	$	60	
fecals	$	35	MF
total	$	*170*	

FWC	cost		source	
TSS	$	25	ARI	
turb	$	20	ARI	
cond	$	20	ARI	
Cl-	$	25	ARI	
Cu Zn Cd Pb	$	290	ARI	TR & diss
Hg	$	30	ARI, assun	for comm/ind landuse
hard	$	65	ARI	
PAHs	$	190	ARI	
phthalates	$	180	ARI	
herbicides	$	200	*TBD*	
pesticides	$	200	*TBD*	
fungicides	$	200	*TBD*	
TN	$	40	ARI	
NOX	$	25	ARI	
TP	$	35	ARI	
ortho-P	$	30	ARI	
BOD	$	45	ARI	
total	$	*1,620*		

acute WET	$	500	depends on dilution series, DQOs, reporting

approximate eqpt costs

item	type		comment
sampler	ISCO	$ 4,000	
flowmeter	area-velocity	$ 4,000	needed for round pipes
flowmeter	pubbler/xducer	$ 3,000	for open channels/weirs/flumes
housing, supplies, installation labor		$ 2,000	plastic garden shed, OEM or steel utility box
telemetry option		$ 8,000	OEM system, cell phone uplink

Sediments	cost		source	
% solids	$	10	ARI	
TOC	$	45	ARI	
metals	$	112		metals, PAHs, phthalates, phenolics and rest of list from Fact Sheet pg 51 table use method 8270 group at $300 + method 8081 for HCB/HCBD at $120
PAHs, phthalates, phenolics	$	300	ARI	
HCB/HCBD	$	120	ARI	
PCBs	$	115	8082	
total option 1	$	*702*	min cost	
total option 2	$	*842*	add split extract 8270 SIM for SMS if needed	
total option 3	$	1,340	full SMS analysis prices	

sediment trap labor hrs per sample	48	3 days for team of 2 (6 man days) to service 3 outfalls
sample events per year	3	
cost per sample event per outfall	$2,620	
cost per outfall per year	$ 7,860	

note: does not include PSD analysis which may be impoprtant to interpret data appropriately

MS4 Permit BMP Effectiveness Monitoring Portion

Comparison of the two draft versions of permit requirements
elements compared side by side, crosshatched where absent in one or the other draft version
significant changes shaded gray

Draft 1 (5/16/05)	element/significant language	Draft 2 (2/15/06)	element/significant language		
S6B	begin section	S8C	begin section		
	"comprehensive, long term"	i	"full scale field monitoring"		
			evaluate O&M rqmts		
	characterize treatment BMPs		√		
	characteize Flow Reduction Strategies		√		
a	2 questions to be addressed				
i	individual option	S8D.1	√		
	collaborative option	S8D.1	√		
	≥2 sites per (treatment) BMP	2	√		
	6 flow reduction strategies (overall among permittees)	S8C.3	√		
	do QAPP for each BMP and Q strategy	S8.C.1	√		
	use qualified staff or contractor				
a.i	TAPE protocol for short det times		TAPE+ECY+EPA Guidance Docs		
			collect BMP database info items		
	test all BMPs listed (12)		choose at least 2 from list of 12		
	all permittees		Cities, counties do at least 2; Ports do at least 1 type		
	design criteria "similar to" manual		design "in accordance with" manual, alts approved in QAPP process or by "petition"		
(1)	Basic (5 public domain)		same list		
(2)	Enhanced (5 public domain)		same list		
(3)	Oil (lin sand filter, CBI)		same list		
ii.	prioritized list				
iii.	one Q strategy per City & County permittee (not Port)	S8.C.3	by paired study or predicted outcome		
iv.	provide staff assistance				
b.	no rqmts for "other special permittees"				
2	Program Dev, review and approval in ≤2 years	S8.E.1/2	< 2yrs individ, < 2.5 yrs collaborative		
	QAPP review by ECY	S8.D.2	√		
	methods, freq defined by permitte's QAPP		statistical goal 95% confidence, 80% power, "max 35 sample pairs will suffice"	param cost source	
Flow (rate, dur, vol)	all				
event wx info	all				
TSS	all		all	$ 25	ARI
PSD			all	$ 95	ARI
pH	all		all	$ 15	ARI
hard	all		in BASIC and ENH	$ 65	ARI
temperature	all				
TPH-Dx & Gx			oil control	$ 135	ARI
sheen			oil control	0	
TR and diss Cu, Zn	all		in BASIC and ENH	$ 160	ARI
TR and diss As, Cd,	all				
BNAs	all				
pesticides	all				
TN	all				
TP	all		in BASIC and ENH	$ 35	ARI
NOX	all				
Ortho-P	all		in BASIC and ENH	$ 30	ARI
BOD	all				
E. Coli	all				
Enterococcus	all				
Toxicity	all				
sediment sampling			No details on methods, freq, evaluation (e.g. TCLP, MTCA, sed stds), etc; TAPE & stat goals would not make sense		
sediment testing			%Solids, grain size, TVS, TPH-Dx, Cd, Cu, Pb, Zn, TP		
i.	"framework for Ph II permittees"				
j.	adopted in ≤30 months		Inital info in 1 yr, 1.5 yrs for final QAPP (2.5 if collab)		
k.	implmented in ≤36 months		< 2yrs individ, < 2.5 yrs collaborative		
3	annual monitoring report by end of year, begin 2009	S8.E.1.e/d; S8.F.c	in annual overall program report and another, final report submitted in <4 years		

Cost Estimate for 2/15/06 Draft MS4 Permit Stormwater Monitoring for Treatment BMP Effectiveness (S8.C)

Scope Narrative, per permittee

- 4 BMP installations with a pair of auto samplers and flowmeters at each BMP inlet and outlet=8 monitoring stations.
- 1 flow control BMP (paired inlet/outlet continuous flow monitoring)
- full QAPP+TAPE for each BMP (thus, 2 QAPPs, but that is not necessary, so assume single QAPP)
- Implement by end of year 2, sample ~2 years, submit final report by end of year 4
- assume min 20 events (up to 35 in ~ 2 years is unlikely achievable)
- *false starts* (good samples, bad events) and *system failures* (bad samples, good events) will be significant
- sediment samples of accumulated sediment in each BMP-permit text vague, assume bulk samples collected at 1/2 the stormwater sampling frequency, assume labor incidental to stormwater sampling

Cost Estimate Factors & Assumptions

# events	20	full analytical & labor, completed in 2 years
# false starts	8	1 per qtr; no analytical spent, but use 50% of event labor
# failures	8	1 per qtr; no analytical spent, but use 50% of event labor
QC rate	20%	field eqpt blanks and dupes for all params
labor rate	$80	consultant supported
labor hrs per event per BMP sampling station pair	48	3 days for team of 2 (6 man days)
labor hrs per annual report per BMP family	50	(100 hours for program per year for 2 years)
labor hrs per final report per BMP family	100	(200 hours total for final report)
flow control labor	480	total hours over 2 years (12 man weeks) for single site for flow monitoring, data synthesis and evaluation

approximate eqpt costs				
Item	type			comment
sampler	ISCO	$	4,000	
flowmeter	area-velocity	$	4,000	needed for round pipes
flowmeter	bubbler/xducer	$	3,000	for open channels/weirs/flumes
housing, supplies, installation labor		$	2,000	plastic garden shed or steel utility box
telemetry option		$	8,000	OEM system, cell phone uplink

BMP family	cost/event/BMP analytical	labor	total	other costs false start	failure	QC analyt	total recuring costs per BMP analyt	labor	sediments	total	eqpt	reporting ann report	final report	total	
BASIC	$ 850	$ 3,840	$ 5,540	$ 1,920	$ 1,920	$ 3,400	$ 20,400	$ 107,520	$ 4,300	$ 132,220	$ 20,000	$ 4,000	$ 8,000	$ 320,440	2 sites
ENH	$ 850	$ 3,840	$ 5,540	$ 1,920	$ 1,920	$ 3,400	$ 20,400	$ 107,520	$ 4,300	$ 132,220	$ 20,000	$ 4,000	$ 8,000	$ 320,440	"
Oil control	$ 540	$ 3,840	$ 4,920	$ 1,920	$ 1,920	$ 2,160	$ 12,960	$ 107,520	$ 4,300	$ 124,780	$ 13,000	$ 4,000	$ 8,000	$ 291,560	"
subtotal for testing 2 installations of 2 BMPs (Basic+Enh)							*$ 98,800*	*$ 430,080*			*$ 80,000*	*$ 16,000*	*$ 16,000*	*$ 640,880*	
Flow Control								$ 38,400			$ 12,000	$ 4,000	$ 8,000	$ 66,400	*single site*

pick 2 of these 3 BMP families for program for total cost using consultants $ 707,280
above at staff cost of $50/hr $ 513,600

	total	per person	
field labor hours in above	5,856	2,928	includes flow control labor
field labor days in above	732	366	
field labor months in above	37	18	
total reporting labor hours in above	400	$ 32,000	
total annual report hours (2 annual reports)	200		
total final report hours	200		

this portion of the cost estimate does not include QAPP development
does not include mileage, supplies and other ODC

Sediment Monitoring Portion
samples= 10 (assume 50% of water sampling burden)
assume labor covered in stormwater sampling labor above

analyte	cost	source	method
% solids	10	ARI	
grain size	95	ARI	assume sieve+hydrometer
TVS	25	ARI	
TPH-Dx	65	ARI	
Cd	35	ARI	GFAA
Cu	35	ARI	GFAA
Pb	35	ARI	GFAA
Zn	30	ARI	ICP
TP	35	ARI	
digestion	20	ARI	not listed in permit but needed for total metals
TOC	45	ARI	not listed in permit but needed for data interpretation
total	*$ 430*		